AF/2834

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Yoshihito ASAO, et al.

Docket No: Q63652

Appln. No.: 09/838,252

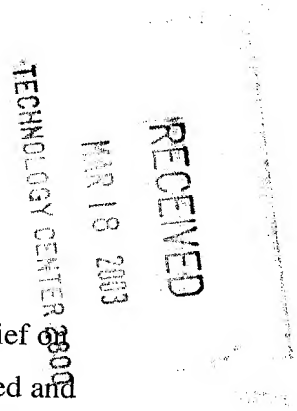
Group Art Unit: 2834

Confirmation No.: 9317

Examiner: Thanh LAM

Filed: April 20, 2001

For: AUTOMOTIVE ALTERNATOR



SUBMISSION OF APPELLANT'S BRIEF ON APPEAL

Commissioner for Patents
Washington, D.C. 20231

Sir:

Submitted herewith please find an original and two copies of Appellant's Brief on Appeal. A check for the statutory fee of $320.00 is attached. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account. A duplicate copy of this paper is attached.

Respectfully submitted,

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WASHINGTON OFFICE

23373
PATENT TRADEMARK OFFICE

Date: March 13, 2003

Attorney Docket No.: Q63652

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APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Commissioner for Patents
Washington, D.C. 20231

Sir:

This is an Appeal from the final rejection of September 11, 2002 (Paper No. 7) of claims 1-12 in Application No. 09/838,252. In accordance with the provisions of 37 C.F.R. § 1.192, Appellant submits the following:

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Mitsubishi Denki Kabushiki Kaisha. Assignment of the application was submitted to the U.S. Patent and Trademark Office on April 20, 2001, and recorded on the same date at Reel 011734, Frame 0788.

II. RELATED APPEALS AND INTERFERENCES

There are no known appeals or interferences that will affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-12 are pending in the application. As set forth in the Office Action dated September 11, 2002, claims 1, 3, 4, 6 and 8-10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Asao et al. (USP 6,049,154; hereafter "Asao") in view of Kitamura et al. (USP 4,739,204; hereafter "Kitamura"). Claims 2, 11 and 12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Asao in view of Kitamura and Adachi (USP 5,798,586). Claims 5 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Asao in view of Kitamura and Ishida (USP 5,708,316). All of the rejected claims are set forth in the attached Appendix.

IV. STATUS OF AMENDMENTS

No claim amendments were requested subsequent to the Office Action of September 11, 2002.

V. SUMMARY OF THE INVENTION

The present invention is directed to an automotive alternator in which a heat-generating portion is cooled by a liquid coolant. (page 1, lines 6 and 7).

As shown in Figures 1 and 2, the automotive alternator, according to a first embodiment of the present invention, comprises a shaft 6 rotatably supported in an aluminum front bracket 1 and an aluminum rear bracket 2 by means of front-end and rear-end bearings 3. A rotor 7 includes a magnetic pole core 8 fastened to the shaft 6, a stationary magnetic pole core 8a fastened to the rear bracket 2, and an excitation winding 9 held by the stationary magnetic pole core 8a. A fan 5 for air agitation inside the brackets 1 and 2 is fastened to a front end surface of the magnetic pole core 8. A stator 10 includes a cylindrical stator core 11 having slots 11a and a stator winding 12 installed in the slots 11a of the stator core 11. The stator 10 is fastened to the front bracket 1 and the rear bracket 2 so as to surround an outer circumferential side of the rotor 7. (page 9, lines 6-18).

An aluminum bracket cover 13 is attached to the rear bracket 2, and a rear-end distribution channel 25 which is recessed into the rear bracket 2 is kept fluid-tight by means of a seal 14. An inflow pipe 16 and an outflow pipe 17 are disposed in the rear bracket 2 so as to be linked to the rear-end distribution channel 25. (page 9, lines 18-23). A heat-conducting filler 23 composed of a thermally-conductive resin is filled in between a front-end coil end group 12f of the stator winding 12 and the front bracket 1, and between a rear-end coil end group 12r of the stator winding 12 and the rear bracket 2. (page 10, lines 15-18).

As shown in Figure 3, the coil end groups 12f and 12r of the stator winding 12 are constructed by arranging coil ends 12a in rows circumferentially, wherein the coil ends 12a extend out from first slots 11a, fold over at end surfaces of the stator core 11, and enter second

slots 11a a predetermined number of slots away. The outer circumferential surfaces of the coil ends 12a form a continuous circumferentially-smooth heat-conducting surface 28. (page 10, lines 22-28).

As shown in Figure 6, the continuous circumferentially-smooth heat-conducting surface 28 of the winding coil ends 12a is formed by rolling the front and rear coil end groups 12f and 12r via rotating rollers 31 while pressing the rollers 31 against the coil end groups 12r and 12f from a radially outer side. Thus, in a region where outer circumferential surfaces of the coil end groups 12f and 12r come into contact with the rollers 31, circumferential irregularities are flattened by the rollers 31 to obtain the stator 10 shown in Figure 3. That is, the outer circumferential surfaces of the coil end groups 12f and 12r are reshaped uniformly in a circumferential direction and irregularities between the coil ends 12a are eliminated on the outer circumferential surfaces of the coil end groups 12f and 12r, thereby forming the circumferentially-smooth heat-conducting surface 28. (page 12, lines 3-17).

VI. ISSUES

Whether claims 1, 4, 6, 8 and 9 were erroneously rejected under 35 U.S.C. § 103(a) as being unpatentable over Asao in view of Kitamura?

VII. GROUPING OF CLAIMS

Appellant submits that the claims of the present application may properly be considered in five groups that are separately patentable and therefore do not stand or fall together.

The proper grouping of the claims is as follows:

Group 1: Independent claim 1 and dependent claims 2 and 3 stand or fall together.

Group 2: Independent claim 4 and dependent claims 4, 5, 10, 11 and 12 stand or fall together.

Group 3: Dependent claims 6 and 7 stand or fall together.

Group 4: Dependent claim 8 stands or falls alone.

Group 5: Dependent claim 9 stands or falls alone.

Reasons for patentability are set forth below.

VIII. ARGUMENTS

As an initial matter, Appellant acknowledges that all of the claims relate an automotive alternator including a stator, a rotor and bracket supporting the stator and the rotor. However, as set forth below, the claims of groups 1-4 each recite different features.

Group 1: Independent claim 1 and dependent claims 2 and 3 stand or fall together as they recite a stator winding wherein a predetermined region of outer surfaces of coil ends of the stator winding in a radial direction of said stator core forms a continuous circumferentially-smooth heat-conducting surface.

Group 2: Independent claim 4 and dependent claims 4, 5, 10, 11 and 12 stand or fall together as they recite each of the wire strands of the stator winding are wound at an interval of a predetermined number of slots so as to alternately occupy an inner layer and an outer layer in a slot depth direction within the slots, and turn portions of the strands of wire are lined up generally uniformly in a circumferential direction.

Group 3: Dependent claims 6 and 7 stand or fall together as they additionally recite the turn portions of the wire strands of the stator winding are disposed circumferentially so as to line up in a plurality of rows radially with radially-adjacent turn portions being in general contact with each other.

Group 4: Dependent claim 8 stands or falls alone as it additionally recites the turn portions are disposed circumferentially such that intermediate portions of the turn portions are in close proximity with each other, the intermediate portions being between portions where the turn portions extend out from the slots and portions where the turn portions are folded back.

Group 5: Dependent claim 9 stands or falls alone as it additionally recites a resin filling the gaps between the turn portions

Accordingly, the claims in ***Groups 1-5*** are believed to be separately patentable because of the limitations therein, and therefore they do not stand and fall together.

A. Claims 1-3 (*Group I*) are Patentable Over the Prior Art

Independent claim 1 requires, in part, "a predetermined region of outer surfaces of said coil ends in a radial direction of said stator core forms a *continuous* circumferentially-smooth heat-conducting surface, said outer surfaces facing radially outwards from said stator core and extending from a vicinity of said end surface of said stator core to apex portions of said coil ends." For example, as shown in Figure 3 of the present application, the stator 10 includes a stator winding 12 installed in a stator core 11, wherein coil end groups 12f and 12r of the stator winding 12 are constructed by arranging coil ends 12a in rows circumferentially, and the outer circumferential surfaces of the coil ends 12a form a continuous circumferentially-smooth heat-conducting surface 28.

In the Office Action dated September 11, 2002 (pages 5 and 6), the Examiner asserts that Kitamura (Figures 3 and 4) discloses the claimed continuous circumferentially-smooth heat-conducting surface via the surface of the enclosure 24 in Figure 3. In particular, the Examiner asserts that "the surface 24 in cross section is obviously shown [as] a continuous circumferentially smooth heat-conducting surface." (page 6, lines 1-3, Office Action dated September 11, 2002). The Examiner further asserts that "[i]t would have been obvious ... to utilize the outer surfaces of end coils of Asao et al. and fit a circumferentially smooth heat-conducting surface as taught by Kitamura et al. to improve heat conducting from the end coils to the cooling channel." (page 6, last full paragraph, Office Action dated September 11, 2002).

Appellant respectfully submits that independent claim 1 would not have been rendered obvious in view Asao and Kitamura because even if Asao and Kitamura are combined in the manner proposed by the Examiner (which Appellant submits is incorrect), the resulting alternator would not include a stator winding wherein a predetermined region of outer surfaces of the coil ends in a radial direction of the stator core forms a continuous circumferentially-smooth heat-conducting surface, as claimed.

The Examiner maintains that Asao (prior art Figs. 7-14) discloses the claimed structure of the stator winding. (pages 2 and 3 of Office Action dated September 11, 2002). However, as shown in Figures 7 and 8 of Asao, the conventional stator 1 includes stator windings 3, wherein coil strands are inserted into every third slot 2a around the core coil strands to form three phases of stator windings 3 in a staggered manner. That is, a first phase of stator winding 3 (external winding 3A) is wound around the radially outer edge of the stator core 2, a second phase of stator winding 3 (internal winding 3B) is wound around the inner edge, and a third phase of winding 3 (intermediate winding 3C) is wound between the other two. (Asao: column 1, lines 7-40).

Thus, similar to the conventional stator shown in Figure 23 and discussed on pages 2 and 3 of the present application, outer circumferential surfaces of coil end groups of the stator winding of Asao have large irregularities in a circumferential direction. Further, because the positions of the slender copper wires in the coil ends are not specified, large irregularities occur on surfaces of the coil ends. Lastly, because the coil ends are formed into bundles of slender

copper wires, the slender copper wires are not in close contact with each other in the coil ends, making thermal conductivity in the coil ends poor.

Accordingly, Applicant respectfully submits that Asao does not teach or suggest a predetermined region of outer surfaces of the coil ends in a radial direction of said stator core forms a continuous circumferentially-smooth heat-conducting surface, as recited in claim 1.

Kitamura (Figures 2-4) discloses enclosing the axial end surfaces of the stator core 10 with an enclosure 24 so as to surround the stator coil 11, and filling the space between the enclosure 24 and the stator coil 11 with an insulating filler 25 such as synthetic resin. (Kitamura: column 2, lines 48-55). Appellant submits that it is quite clear that the enclosure 24 is not part of the coil ends of the stator coil 11, as required by claims 1 and 4. Rather, the enclosure 24 is simply a cover member which is made of a metal having a high thermal conductivity such as aluminum and is positioned such that it does not contact the coil ends of the stator coil 11. The enclosure 24 provides a liquid-tight connection to the stator core 10 to protect the stator coil 11 from liquid coolant flowing through coolant passages 32a and 32b. (Kitamura: column 2, lines 48-55).

Therefore, Appellant respectfully submits if Asao and Kitamura are combined in the manner proposed by the Examiner, such that the coil ends of the stator coil of Asao are surrounded with the enclosure 24 of Kitamura and the spaces between the coil end and the enclosure filled with the resin in order to improve heat conduction from the coil ends to the

cooling channel, the outer surfaces of the coil ends of Asao would not be formed into a continuous circumferentially-smooth heat-conducting surface, as claimed.

Accordingly, Appellant respectfully submits that independent claims 1, as well as dependent claims 2 and 3, should be allowable over the combination of Asao and Kitamura, because the applied references, alone or combined, do not teach or suggest all of the features of the claimed invention.

B. Claims 4, 5, 10, 11 and 12 (*Group 2*) are Patentable Over the Prior Art

Independent claim 4 requires, in part, "a predetermined region of outer surfaces of said coil ends in a radial direction of said stator core forms a circumferentially-smooth heat-conducting surface, said outer surfaces facing radially outwards from said stator core and extending from a vicinity of said end surface of said stator core to apex portions of said coil ends." Claim 4 further recites "said stator winding is provided with a plurality of winding sub-portions each constructed by installing a strand of wire at intervals of a predetermined number of slots so as to alternately occupy an inner layer and an outer layer in a slot depth direction within said slots, turn portions of said strands of wire which are folded back outside said slots at said end surface of said stator core forming said coil ends and lining up generally uniformly in a circumferential direction to constitute a coil end group."

For example, as shown in Figures 7-9 of the present application, a stator winding 12A includes a plurality of winding sub-portions which are constructed by inserting conductor

segments 40 into pairs of slots 11a six slots apart and joining together free end portions 40c of the conductor segments 40 so that the joined conductor segments 40 alternately occupy an inner layer and an outer layer in a slot depth direction in every sixth slot. (page 15, line 7 - page 16, line 23).

Coil ends folded over outside the slots 11a at a rear-end surface of a stator core 11A (i.e., the turn portions 40a of the conductor segments 40) are arranged uniformly in a circumferential direction to form two rows in a radial direction, constituting a rear-end coil end group 12r. Coil ends folded over outside the slots at a front-end surface of a stator core 11A, that is, the joint portions 41 joining together the free end portions 40c of the conductor segments 40, are also arranged uniformly in a circumferential direction to form two rows in a radial direction, constituting a front-end coil end group 12f. Outer circumferential surfaces of the coil end groups 12f and 12r are constructed such that smooth side surfaces 42 constituted by the short sides of the rectangular cross sections of the conductor segments 40 extending outwards from the slots 11a as far as apex portions are arranged uniformly in a circumferential direction. Moreover, the side surfaces 42 of the conductor segments 40 constitute heat-conducting surfaces. (page 17, line 22 - page 18, line 7).

Because the heat-conducting surfaces are arranged uniformly in the circumferential direction, the surface area of the heat-conducting surfaces in the outer circumferential surfaces of the coil end groups 12f and 12r is enlarged, the thermal contact surface between a heat-conducting filler 23 and the coil end groups 12f and 12r is increased, and heat from the stator

winding is transferred efficiently to the heat-conducting filler 23, raising the cooling efficiency of the stator 10A. (page 18, line 26 - page 19, line 3).

The Examiner maintains that Asao (prior art Figs. 7-14) discloses the claimed structure of the stator winding. (pages 2 and 3 of Office Action dated September 11, 2002). However, Figs. 7-14 show that the strands of wire occupy the same layer in a slot depth direction within the slots and "the coil end portions 3b of the stator windings 3 are not aligned". (Asao: column 2, lines 57 and 58; and column 3, lines 3 and 4). That is, each coil end extends from a slot pair at the same slot position. Further, on page 6 of the Office Action dated September 11, 2002, the Examiner admits that "Asao (fig. 5) discloses the strands (4) of the wire occupy the same layer in a slot (2a) depth direction within the slot with end turn portion[s] of the strands of wire lined up in the radial direction."

Similarly, Kitamura fails to teach or suggest this feature of the claimed invention since the reference does not disclose the construction of the stator winding.

Accordingly, Appellant respectfully submits that the combination of Asao and Kitamura does not teach or suggest the stator winding in which each of the strands of wire is wound at an interval of a predetermined number of slots so as to alternately occupy an inner layer and an outer layer in a slot depth direction within the slots, and turn portions of the strands of wire are lined up generally uniformly in a circumferential direction, as claimed.[1]

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[1] In Office Action (page 6) dated September 11, 2002, the Examiner states that Appellant argues that claim 4 should be allowable because "Asao does <u>not</u> disclose the strands of wire occupy the same layer in a slot depth direction within the slots with the turn portion[s] of the strands of wire lined up in ...(footnote continued)

Therefore, Appellant respectfully submits that claims 4, 5, 10, 11 and 12 should be allowable over the combination of Asao and Kitamura because the applied references, alone or combined, do not teach or suggest all of the feature of the claimed invention.

C. Claims 6 and 7 (*Group 3*) are Patentable Over the Prior Art

In addition to the limitations discussed above with regards to independent claim 4, dependent claim 6 recites "said turn portions are disposed circumferentially so as to line up in a plurality of rows radially, radially-adjacent turn portions being in general contact with each other." For example, as shown in Figures 19 and 20, the stator 10C is constructed by installing winding assemblies 50 in three layers into the stator core 11A. Thus, a stator winding 12C is constituted by two three-phase alternating-current winding sets in which winding phase portions having six turns each are connected into alternating-current connections. Further, the stator winding 12C is constructed such that turn portions 45a disposed circumferentially so as to line up in three rows radially are compressed from first and second sides in a radial direction so as to be in close contact with each other. (page 27, lines 19-27).

Although the Examiner cites Figures 7-14 of Asao in rejecting independent claim 4 (pages 2 and 3, Office Action dated September 11, 2002) and generally alleges that Asao

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the radial direction" (emphasis added). However, the Examiner's characterization of Appellant's arguments is incorrect (i.e., the opposite of what stated in the Amendment filed June 28, 2002) since Appellant argued that independent claim 4 should be allowable because "Asao discloses that the strands of wire occupy the same layer in a slot depth direction within the slots with the turn portions of the strands of wire lined up in the radial direction."

discloses the subject matter of claim 6, the Examiner simply quotes the language of claim 6 without citing any portion of the specification or drawings of Asao in support of the rejection of claim 6. (page 4, Office Action dated September 11, 2002).

Appellant respectfully submits that the combination of Asao and Kitamura fail to disclose subject matter of claim 6. In particular, Figures 7-14 (cited in rejecting claim 4) of Asao show that the coil end portions of the stator windings are not aligned. (Asao: column 2, lines 57 and 58; and column 3, lines 3 and 4).

Similarly, Kitamura fails to teach or suggest this feature of the claimed invention since the reference does not disclose the construction of the stator winding.

Accordingly, Appellant respectfully submits that claims 6 and 7 should be allowable over the combination of Asao and Kitamura because the applied references, alone or combined, do not teach or suggest all of the features of the claimed invention.

D. Claim 8 (*Group 4*) is Patentable Over the Prior Art

In addition to the limitations discussed above with regards to independent claim 4, dependent claim 8 recites "said turn portions are disposed circumferentially such that intermediate portions of said turn portions are in close proximity with each other, said intermediate portions being between portions where said turn portions extend out from said slots and portions where said turn portions are folded back." For example, as shown in Figure 21, portions of the continuous conductors 45 extending outwards from the slots to the apex portions

are inclined such that the turn portions 45a disposed circumferentially come into close contact with each other. (page 29, lines 1-5).

Although the Examiner cites Figures 7-14 of Asao in rejecting independent claim 4 (pages 2 and 3, Office Action dated September 11, 2002) and generally alleges that Asao discloses the subject matter of claim 8, the Examiner simply quotes the language of claim 8 without citing any portion of the specification or drawings of Asao in support of the rejection of claim 8. (page 4, Office Action dated September 11, 2002).

Appellant respectfully submits that the combination of Asao and Kitamura fail to disclose subject matter of claim 8. In particular, Figures 7-14 (cited in rejecting claim 4) of Asao show that the coil end portions of the stator windings are not aligned. (Asao: column 2, lines 57 and 58; and column 3, lines 3 and 4).

Similarly, Kitamura fails to teach or suggest this feature of the claimed invention since the reference does not disclose the construction of the stator winding.

Accordingly, Appellant respectfully submits that claim 8 should be allowable over the combination of Asao and Kitamura because the applied references, alone or combined, do not teach or suggest all of the features of the claimed invention.

E. Claim 9 (*Group 5*) is Patentable Over the Prior Art

In addition to the limitations discussed above with regards to independent claim 4, dependent claim 9 recites "a resin is filled between said turn portions such that a surface of said

resin is positioned in a common plane with a surface of said strand of wire, said heat-conducting surface being constituted by a smooth surface composed of said surface of said strand of wire and said surface of said resin." For example, as shown in Figure 22, resin portions 57 are formed on the outer circumferential surfaces of the front-end and rear-end coil end groups 12f and 12r so as to be positioned in a common plane with side surfaces 46 formed by the short sides of the rectangular cross sections of the continuous conductor wires 45. In other words, the side surfaces 46 of the continuous conductor wires 45 constituting the heat-conducting surfaces are exposed from the resin portions 57. Thus, the outer circumferential surfaces of the front-end and rear-end coil end groups 12f and 12r are formed into smooth surfaces constituted by the side surfaces 46 formed by the short sides of the rectangular cross sections of the continuous conductor wires 45 and the resin portions 57. (page 29, line 23 - page 24, line 6).

Although the Examiner cites Figures 7-14 of Asao in rejecting independent claim 4 (pages 2 and 3, Office Action dated September 11, 2002) and generally alleges that Asao discloses the subject matter of claim 9, the Examiner simply quotes the language of claim 9 without citing any portion of the specification or drawings of Asao in support of the rejection of claim 9. (page 4, Office Action dated September 11, 2002).

Appellant respectfully submits that the combination of Asao and Kitamura fail to disclose subject matter of claim 9. In particular, Figures 7-14 (cited in rejecting claim 4) of Asao show the resin does not fill the gaps between the turn portions.

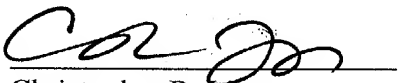
Similarly, Kitamura fails to teach or suggest this feature of the claimed invention since the reference does not disclose the construction of the stator winding.

Accordingly, Appellant respectfully submits that claim 9 should be allowable over the combination of Asao and Kitamura because the applied references, alone or combined, do not teach or suggest all of the features of the claimed invention.

The present Brief on Appeal is being filed in triplicate. Unless a check is submitted herewith for the fee required under 37 C.F.R. §1.192(a) and 1.17(c), please charge said fee to Deposit Account No. 19-4880.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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Attorney Docket No.: Q63652

APPENDIX

CLAIMS 1-12 ON APPEAL:

1. (Amended) An automotive alternator comprising:

a stator having a stator core formed with slots extending axially at a predetermined pitch in a circumferential direction and a stator winding installed in said stator core;

a rotor rotatably disposed on an inner circumferential side of said stator; and

a bracket for supporting said stator and said rotor,

wherein a coil end group of said stator winding is constructed such that coil ends folded back outside said slots at an end surface of said stator core are arranged circumferentially,

wherein a predetermined region of outer surfaces of said coil ends in a radial direction of said stator core forms a continuous circumferentially-smooth heat-conducting surface, said outer surfaces facing radially outwards from said stator core and extending from a vicinity of said end surface of said stator core to apex portions of said coil ends, and

wherein a distribution channel for a liquid coolant is disposed for absorbing heat generated in said stator and conducted from said heat-conducting surface.

2. The automotive alternator according to Claim 1 wherein said distribution channel is formed inside said bracket, a thermally-conductive resin being filled between said coil end group and said bracket in a state of general contact with said heat-conducting surface.

3. The automotive alternator according to Claim 1 wherein said distribution channel is constituted by a tube composed of a thermally-conductive material, a portion of said tube being disposed in a state of general contact with said heat-conducting surface of said coil end group.

4. (Amended) An automotive alternator comprising:

a stator having a stator core formed with slots extending axially at a predetermined pitch in a circumferential direction and a stator winding installed in said stator core;

a rotor rotatably disposed on an inner circumferential side of said stator; and

a bracket for supporting said stator and said rotor,

wherein said stator winding is provided with a plurality of winding sub-portions each constructed by installing a strand of wire at intervals of a predetermined number of slots so as to alternately occupy an inner layer and an outer layer in a slot depth direction within said slots, turn portions of said strands of wire which are folded back outside said slots at said end surface of said stator core forming said coil ends and lining up generally uniformly in a circumferential direction to constitute a coil end group,

wherein a predetermined region of outer surfaces of said coil ends in a radial direction of said stator core forms a circumferentially-smooth heat-conducting surface, said outer surfaces

facing radially outwards from said stator core and extending from a vicinity of said end surface of said stator core to apex portions of said coil ends, and

wherein a distribution channel for liquid coolant is disposed for absorbing heat generated in said stator and conducted from said heat-conducting surface.

5. The automotive alternator according to Claim 4 wherein said strand of wire is formed with a rectangular cross-sectional shape, said heat-conducting surface being constituted by a flat side surface of said strand of wire.

6. The automotive alternator according to Claim 4 wherein said turn portions are disposed circumferentially so as to line up in a plurality of rows radially, radially-adjacent turn portions being in general contact with each other.

7. The automotive alternator according to Claim 6 wherein said strand of wire is formed with a rectangular cross-sectional shape, said heat-conducting surface being constituted by a flat side surface of said strand of wire.

8. The automotive alternator according to Claim 4 wherein said turn portions are disposed circumferentially such that intermediate portions of said turn portions are in close

proximity with each other, said intermediate portions being between portions where said turn portions extend out from said slots and portions where said turn portions are folded back.

9. The automotive alternator according to Claim 4 wherein a resin is filled between said turn portions such that a surface of said resin is positioned in a common plane with a surface of said strand of wire, said heat-conducting surface being constituted by a smooth surface composed of said surface of said strand of wire and said surface of said resin.

10. The automotive alternator according to Claim 4 wherein said strand of wire is a continuous wire.

11. The automotive alternator according to claim 4, wherein said distribution channel is formed inside said bracket, a thermally-conductive resin being filled between said coil end group and said bracket in a state of general contact with said heat-conducting surface.

12. The automotive alternator according to claim 4, wherein said distribution channel is constituted by a tube composed of a thermally-conducting material, a portion of said tube being disposed in a state of general contact with said heat-conducting surface of said coil end group.